

Remarks

Applicants note with appreciation the Examiner's telephone conversation with Applicants' representative on August 13, 2003 and the resulting provisional election of Group 1 including Claims 1-8, 13-15, 17, 18, 21 and 22.

Applicants have amended Claim 4 to remove the phrase "preferably" and further amended Claim 4 to place it into independent form and into a form for allowance. Applicants note with appreciation the allowance of Claims 13-15, and 17-18.

Claim Rejections Under 35. U.S.C. §103

Claims 1-3, 5-8, 21 and 22 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Kaneko et al. (U.S. Patent 6,425,963), Hashimoto et al. (U.S. Patent 4,339,284), Suemura et al. (U.S. Patent 4,348,229) or Osawa et al. (U.S. Patent 5,098,491).

Applicants note with appreciation the Examiner's frank acknowledgement on page 4 of the Office Action that Kaneko et al. discloses a steel sheet that is hot rolled. Applicants, however, claim a cold rolled steel.

The Applicants do not claim the process. They claim a cold rolled steel. Those of ordinary skill in the art know that cold rolled steels have characteristics that are inherently different from the characteristics of hot rolled steel. This is much like pasteurized vs. nonpasteurized milk. The two types of milk have specific characteristics that are sharply different from one another. Thus, the Applicants claim a particular type of steel, not the actual process that brings about the type of steel.

Applicants respectfully submit that the "hot rolled" sheet described in Kaneko et al. makes it difficult to obtain a high r-value because the ferrite aggregation texture is made random due to the austenite ferrite transformation. As such, the hot rolled sheet does not have sufficient

deep drawability. More importantly, the “hot rolled” sheet described by Kaneko et al. would not necessarily contain a dissolved N content of 0.0010% or more, and nor would the sheet have an excellent strain aging hardenability of $BH \geq 80\text{MPa}$ and $\Delta TS \geq 40\text{MPa}$. In fact, the Applicants have surprisingly found that the microstructure and dissolved N content can be controlled, in part, by the cold rolling annealing conditions as described on pages 45-48 of the Specification. The Applicants have also found that the cooling rate should be 10°C/s or more to ensure the proper amount of dissolved N. (Applicants’ Specification page 45, line 22-23). Applicants submit that nowhere in Kaneko et al. is there a description of such a process that would lead to the specified dissolved N content, which provides excellent strain age hardenability ($BH \geq 80\text{MPa}$ and $\Delta TS \geq 40$). The Examiner is invited to consider page 11, lines 4-15, which demonstrate the benefits of steel made through a cold-rolled production process, when it is stated that:

Furthermore, even if the hot-rolled steel sheet obtained by this technique is used as a starting material for cold rolling and recrystallization annealing, the increase in tensile strength obtained after forming and heat treatment is not always equivalent to a hot-rolled steel sheet, and a BH amount of as high as 80 MPa or more cannot be always obtained. This is because the microstructure of the cold-rolled steel becomes different from that of hot-rolled one due to cold rolling and recrystallization annealing, and strain greatly accumulates during cold rolling to easily form a carbide, a nitride or a carbonitride, thereby changing the states of dissolved C and dissolved N.

In view of the foregoing, Applicants respectfully submit that the Applicants’ cold-rolling results in a different type of steel, which is vastly different from the steel of Kaneko et al. Applicants respectfully submit that the current rejection is essentially an “inherency” rejection. It is the burden of the PTO to provide the rationale or evidence showing inherency. MPEP §2112 states in pertinent part:

A fact that a certain result or characteristic **may** occur or be present in the prior art is not sufficient to establish inherency of that result or characteristic. *In re Rijckaert*, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993) (reversed rejection because inherency was based on what would result due to optimization of conditions, not what was **necessarily** present in the prior art); *In re Oelrich*, 212 USPQ 323, 326 (CCPA 1981)[emphasis added].

The Applicants respectfully submit that the hot rolling process described in Kaneko et al. does not necessarily lead to the steel in the Applicants' Claims 1-3, 5-8, and 21-22 that result from cold rolling. In fact, a study of production methodologies of Kaneko et al., would lead to a steel which fails to contain the claimed dissolved N content.

Kaneko also does not disclose the following meaningful elements of the rejected claims:

(1) $0.005 \leq Al < 0.030 \%$; and

(2) $0.005 \leq N \leq 0.040 \%$.

The inventors herein surprisingly discovered that when N in a solid solution state reaches 0.0010 % or more, ΔTS becomes 50 MPa or more and, on the basis of this discovery, this invention came about. The term ΔTS in a steel sheet means the magnitude of tensile strength which is increased by strain age-hardening. As the ΔTS value becomes larger, the steel sheet becomes superior.

The value of ΔTS will be explained in terms of the manufacture of an automobile, as an example. At a stage where auto parts are manufactured by subjecting a steel sheet to press forming, the softer the steel sheet is, the more excellent formability the steel sheet has. This makes the steel sheet satisfactory for its intended purpose. On the contrary, with a completed automobile, the harder the steel sheet is, the more durability and resistance to breakage the automobile has, which is good. The steel sheet of Claims 1 – 3, 5 – 8 and 21 – 22 is soft at the time when used for working for forming auto parts and the strength therein is increased when

baking after painting is effected to the auto parts (normally, 170°C x 20 min or so). The strength increases because the tensile strength of the steel sheet is increased by strain age-hardening.

There have conventionally been no cold rolled steel sheets of this type mentioned above. The mechanism of strain age-hardening of the cold rolled steel sheet is believed to be, as follows: first, a great deal of dislocations is generated by working. N in a solid solution state is diffused during an increase in temperature, which is caused by painting and baking, and gathers around the dislocations thereby displacement of dislocations is suppressed. As a result of the facts mentioned above, the strength of the cold rolled steel sheet increases. In view of the foregoing mechanism, securement of N in a solid solution state is important. For the purpose of satisfying this, the content of Al, which combines with N (precipitated as AlN) and decreases N in a solid solution state, is reduced to the extent possible. To industrially manufacture a cold rolled steel sheet for practical use, it is required to satisfy the composing elements of this application as mentioned above in (1) and (2).

As noted above, Kaneko is concerned with a hot rolled steel sheet, whereas the steel sheets of Claims 1 – 3, 5 – 8 and 21 – 22 are cold rolled. A hot rolled steel sheet and a cold rolled steel sheet substantially differ from each other in terms of their manufacturing methods and microstructures. The significant difference of a cold rolled steel sheet, when compared with a hot rolled steel sheet, is that a cold rolled steel sheet is additionally subjected to the processes of cold rolling and annealing. Securement of a solid solution N amount necessitates further rigorous suppression of N precipitation by AlN and so forth. According to Claims 1 – 3, 5 – 8 and 21 – 22, there are specified $0.005 \leq N \leq 0.040 \%$; $0.005 \leq Al < 0.030 \%$; and $N/Al \geq 0.3$ and it is understood from the composition that suppression of N precipitation is taken into

consideration therefor, when compared with the compositions of Kaneko wherein $0.003 \leq N \leq 0.02 \%$ and $0.001 \leq Al \leq 0.1 \%$ is defined.

In Column 7, from line 19, of Kaneko, there is set forth a restriction meaning that Al of 0.001 % or more is contained as a deoxidizing element, but the content should not exceed 0.1 % from the viewpoint of maintaining surface properties. In a case as mentioned above, wherein Al is contained in large quantities, solid solution N is not able to be acquired. Examples, in Table 1 of Kaneko, which satisfy $N/Al \geq 0.3$ contain 0.030 % or more Al and this is out of the range defined in Claims 1 – 3, 5 – 8 and 21 – 22. None of the restrictions pertaining to Al content to be reduced to a low level is taught by Kaneko. Furthermore, Kaneko specifies a ratio of N_{gb}/N_g : 100 to 10,000. A hot rolled steel sheet after coiling is held at a high temperature for one hour or more. The examples of Kaneko in Table 2 were held at a temperature in a range of 340 to 660°C. Segregation is considered to have been generated in this length of time. In contrast, because the length of time wherein a temperature is held at a high level in annealing, effected after cold rolling, is several minutes, segregation of N does not occur in the crystal grain boundaries. In a cold rolled steel sheet, in contrast to a hot rolled steel sheet, the Al content is necessary to be reduced so that N and Al in the crystal grain boundaries will not be combined. Thus, Claims 1 – 3, 5 – 8 and 21 – 22 are anything but obvious over Kaneko.

In turning to consideration of Hashimoto et al., Suemura et al., and Osawa et al., the Office Action acknowledges that none of the aforementioned references disclose a dissolved N content of 0.0010% or more. Applicants respectfully submit that until the Applicants' discovery, the prior art did not recognize nitrogen as a strengthening element in a field requiring high processability to effectuate strain age hardening. Moreover, the Applicants respectfully submit that the prior art did not recognize the use of N as a strengthening element to create a steel sheet

having a high R value and excellent moldability as compared with conventional prior art solid-solution strengthening type C-Mn steel sheets. (Applicants' Specification, page 14, lines 8-18). It is respectfully submitted that a dissolved N content of 0.0010% or more produces unexpected results, namely, the dissolved N derived through cold rolling a steel sheet with a high r-value, excellent strain age hardening ($BH \geq 80\text{MPa}$ and $\Delta TS \geq 40$), and excellent press moldability. Furthermore, the Applicants recognized that, in order to cause 0.0010% or more of dissolved N to stably remain in the product state, the amount of Al, which is the element for strongly fixing N, must be limited. Applicants have demonstrated that a dissolved N content of 0.0010% or more provides strength to the steel sheet by solid solution strengthening of strain age hardening. Until the Applicants' discovery, the prior art did not recognize the importance of maintaining a minimum dissolved N content to create a strong moldable steel.

Applicants respectfully submit that there is no basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristics (a dissolved nitrogen content of 0.001% or more) necessarily flows from the teachings of the applied prior art. The Court of Appeals for the Federal Circuit wrote in, *In re Robertson*, 49 USPQ2d 1949, at 1950-51:

To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill.'

Applicants respectfully submit that the burden to show the inherency of the Applicants' claimed dissolved N content and its correlation to a defined Al content has not been met since there is no evidence on this record that such a dissolved N content necessarily flows from the teaching of the prior art. Nothing in the prior art discloses a methodology, which would lead to a defined

dissolved N content. For example, the Applicants respectfully submit that the annealing conditions properly controlled the dissolved N content. The prior art did not recognize the importance of such conditions. (Applicants' Specification pages 14 - 15). Moreover, the Applicants employ different methodology to produce the claimed steel. This results in inherently different steel from the prior art.

For example, Hashimoto does not disclose important elements from Claims 1 – 3, 5 – 8 and 21 – 22:

(4) Solid solution N ≥ 0.0010 %; and

(5) $\Delta TS \geq 50$ Mpa.

In sharp contrast to Claims 1 – 3, 5 – 8 and 21 – 22, Hashimoto is directed to the manufacture of cold rolled soft steel sheets which do not have strain age hardenability. For example, in Hashimoto at Column 5, beginning at line 40, Hashimoto states “When the nitrogen content in a steel is increased, aluminum must be used in a larger amount corresponding to the amount of nitrogen.” In addition, beginning at line 53, there is disclosed that boron can be added to steel to fix nitrogen in the form of BN. That is to say, solid solution N is positively reduced to eradicate age-hardening. When looking at the examples tabulated in Tables 1 and 2 of Hashimoto, $0.27 \leq N/Al \leq 0.48$. However, while continuous annealing is practiced as a manufacturing method for steel sheets of Claims 1 – 3, 5 – 8 and 21 – 22, according to Hashimoto, box annealing is employed. The length of soaking time in annealing in a case of a continuous annealing process is one minute or so whereas, approximately 30 hours is spent as the soaking time in annealing by box annealing (Column 6, line 3 from the bottom). It is contemplated that because AlN is generated during box annealing, solid solution N scarcely remains. Consequently, solid solution N ≥ 0.0010 % is unable to be achieved by Hashimoto. It

is noted that the Al contents of the examples shown in Table 3 of Hashimoto are approximately 0 to 0.2 kg/mm². The property of strain age hardening scarcely exists therein. Thus, Claims 1 – 3, 5 – 8 and 21 – 22 are anything but obvious over Hashimoto.

Osawa also does not teach or suggest important elements from Claims 1 – 3, 5 – 8 and 21 – 22 below:

(6) Solid solution N ≥ 0.0010 %; and

(7) $\Delta TS \geq 50$ MPa.

The object of Osawa is the manufacture of a cold rolled soft steel sheet having excellent deep drawability and surface quality. This is fundamentally different from the manufacture of a high-strength steel sheet having excellent strain age hardenability, which is the object of Claims 1 – 3, 5 – 8 and 21 – 22. Osawa has a specific feature, that is to say, B is included in large amounts (0.007 to 0.020 %) when compared with that of Claims 1 – 3, 5 – 8 and 21 – 22. Osawa positively reduces solid solution B to improve surface quality that is apt to be deteriorated, wherein the deterioration is induced because of the content of B in large quantities. In other words, the reduction of solid solution B is effected by precipitating and fixing B as BN (Column 6, from line 45). Also, in Column 7, from line 10, there is set out that N is precipitated and fixed as BN due to the B-added steel. From this, solid solution N is positively reduced in view of improving surface quality. In sharp contrast, in Claims 1 – 3, 5 – 8 and 21 – 22, solid solution N is positively increased to secure excellent strain age hardenability. Thus, the two inventions are completely contrary to one another.

As a practical matter, the chemical composition of the examples tabulated in Table 4 of Osawa indicates that $0.0070\% \leq B \leq 0.0189\%$. Further, it is noted that Al contents are 0 to 2.4

kgf/mm² or so in Table 6 and this discloses that almost no strain age hardenability is provided.

Thus, Claims 1 – 3, 5 – 8 and 21 – 22 are not obvious over Osawa.

Suemura does not teach or suggest important elements of Claims 1 – 3, 5 – 8 and 21 – 22 below:

(8) Solid solution N ≥ 0.0010 %; and

$\Delta TS \geq 50$ MPa.

The foregoing elements are not able to be derived from the contents of Suemura. The object of Suemura is, like Osawa, the manufacture of a cold rolled steel sheet having excellent deep drawability and surface quality. This is fundamentally different from the manufacture of a high-strength steel sheet having excellent strain age hardenability, which is the object of Claims 1 – 3, 5 – 8 and 21 – 22. Suemura is specifically characterized in that Al and B are contained in large amounts, when compared with those specified in Claims 1 – 3, 5 – 8 and 21 – 22. Suemura positively reduces solid solution B to improve surface quality which is apt to be deteriorated, wherein the deterioration is induced because of said content of B in large quantities. It is set out that, for the sake of the foregoing matter, B is fixed as BN through precipitation (Column 2, from line 48). In the same way, in Column 2, from line 60, there is set out that N combines with B to form BN in the steel. Additionally, in Column 2, from line 37, there is set forth that Al is positively added to fix solid solution N as AlN. The Al addition is defined in Suemura to improve press formability and to achieve the non-aging property. Suemura is quite different in technical concept from Claims 1 – 3, 5 – 8 and 21 – 22 wherein, for obtaining excellent strain age hardenability, solid solution N is positively utilized. The chemical composition of Suemura in Table 1 shows $0.023 \leq Al \leq 0.062$ %; $0.0083 \leq B \leq 0.0171$ % and $0.0089 \leq N \leq 0.0160$ % and it is presumed therefrom that solid solution N hardly remains. Thus, Claims 1 – 3, 5 – 8

and 21 – 22 are not obvious over Suemura. In view of the foregoing, the Applicants respectfully request the withdrawal of the rejections of Claims 1-3, 5-8, and 21-22 based on Kaneko et al., Hashimoto et al., Suemura et al., and Osawa et al.

In view of the foregoing, Applicants respectfully submit that the application is in a condition for allowance, which action is respectfully requested.

Respectfully submitted,



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